

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2320
Solution
Gaithersburg, Maryland 20899-2320

SRM Number: 3135a
MSDS Number: 3135a
SRM Name: Neodymium Standard

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Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of neodymium. One unit of SRM 3135a consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of neodymium. The solution contains nitric acid at a volume fraction of approximately 10 %.

Material Name: Neodymium Standard Solution

Other Designations:

Neodymium: Nd; elemental neodymium

Neodymium Nitrate: Neodymium (III) nitrate; neodymium trinitrate.

Nitric Acid: Aqua fortis; hydronitrate; azotic acid; engraver's acid.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	10
Neodymium Nitrate	13746-96-8	(Not found)	2.3
Neodymium	7440-00-8	231-109-3	1

EC Classification, R/S Phrases: Refer to Section 15, Regulatory Information.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 4 Fire = 0 Reactivity = 2

Major Health Hazards: Nitric acid can cause severe or fatal burns if inhaled, swallowed, or absorbed through the skin. Neodymium and its compounds are relatively nontoxic, but a large dose may cause severe illness including possible anemia or kidney damage.

Physical Hazards: None documented for this mixture; glass container may shatter.

Potential Health Effects

Inhalation:	Nitric acid, if inhaled, can damage the mucous membranes and respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Inhalation of neodymium and its compounds can irritate the respiratory tract; prolonged exposure to neodymium or other rare earth materials may cause itching, sensitivity to heat, and an increased awareness of odor and taste.
Skin Contact:	Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Intact skin is unlikely to be irritated by contact with neodymium or other rare earth materials.
Eye Contact:	Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Neodymium nitrate and other water-soluble neodymium compounds are more likely to cause eye irritation than elemental Nd.
Ingestion:	Nitric acid can cause severe burns and damage to the GI tract. Neodymium and other rare earth materials have low toxicity by this route, but a large dose may cause drowsiness, anorexia, nausea, vomiting, a metallic taste in the mouth, and itching. Prolonged exposure to high levels of neodymium may cause bone marrow depression, anemia, impaired blood clotting, and damage to the central nervous system and kidneys.

Medical Conditions Aggravated by Exposure: None documented. The mixture may aggravate pre-existing disorders of the eyes, skin, respiratory tract, kidneys, nervous system, or blood.

Listed as a Carcinogen/ Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

Note: Inhalation or injection of neodymium and other rare earths have caused tumors in laboratory animals.

4. FIRST AID MEASURES

Inhalation: Move the person to fresh air immediately. If not breathing, qualified personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

Skin Contact: Remove contaminated clothing and shoes. Flush affected skin with water for at least 15 minutes, then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

Eye Contact: Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

Note to Physician (Nitric Acid): Wash affected skin with 5% solution of sodium bicarbonate (NaHCO₂). Activated charcoal is of no value. Do not give bicarbonate to neutralize the material.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: No data are available for this mixture, but it is not believed to be a significant fire or explosion hazard. The behavior of the solution may differ from that of the individual components. Nitric acid and neodymium nitrate are oxidizing agents that can react with combustible materials to cause fires. Neodymium metal powder (not present in this mixture) may be listed as a pyrophoric metal for shipping purposes. Otherwise, neodymium and neodymium nitrate are negligible fire hazards.

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire: water spray, dry chemical, carbon dioxide, or foam. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen. (These guidelines apply to the mixture; when the components are considered separately, different precautions may apply.)

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point (°C): N/A

Autoignition (°C): N/A

Lower Explosive Limit (LEL): N/A

Upper Explosive Limit (UEL): N/A

Flammability Class (OSHA): N/A

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Notify safety personnel of spills. Surfaces contaminated with this material should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Disposal: Refer to Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

Storage: Store unopened containers of this material in a dry place at room temperature. Protect from physical damage, heat, and light, and isolate from incompatible materials. Use opened containers immediately or discard.

Safe Handling Precautions: Wear gloves and chemical safety goggles (Section 8). Engineering controls should maintain airborne concentrations below TLV (Section 8).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Nitric Acid:

ACGIH TLV-TWA: 2 ppm or 5 mg/m³

OSHA TLV-TWA: 2 ppm or 5 mg/m³

Neodymium Nitrate: No TLV has been established for this material in solution.

Neodymium: No TLV has been established for this material in solution.

Ventilation: Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

Respirator: If necessary, refer to the NIOSH document *Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84* for selection and use of respirators certified by NIOSH.

Eye Protection: Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

Personal Protection: Wear appropriate gloves and protective clothing to prevent contact with skin.

9. PHYSICAL AND CHEMICAL PROPERTIES

Nitric Acid	Neodymium Nitrate	Neodymium
Appearance and Odor: Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	Appearance and Odor: Lavender, crystalline powder; slightly hygroscopic.	Appearance and Odor: Silvery-gray metal that becomes yellowish on exposure to air.
Relative Molecular Weight: 63.02	Relative Molecular Weight: 330.25	Relative Molecular Weight: 144.24
Molecular Formula: HNO ₃	Molecular Formula: Nd(NO ₃) ₃	Molecular Formula: Nd
Specific Gravity: 1.05 (10%)	Specific Gravity: N/A	Specific Gravity: 7.0
Solvent Solubility: Decomposes in alcohol	Solvent Solubility: Soluble in alcohol, acetone, strong mineral acids	Solvent Solubility: Soluble in dilute acids
Water Solubility: Soluble	Water Solubility: Soluble	Water Solubility: Decomposes
Boiling Point (°C): 86 (187°F)	Boiling Point (°C): N/A	Boiling Point (°C): 3100 (5612°F)
Vapor Pressure (Pa): 946 @20°C	Vapor Pressure (Pa): N/A	Vapor Pressure (Pa): Negligible
Vapor Density (Air=1): 2.17	Vapor Density (Air=1): N/A	Vapor Density (Air=1): N/A
pH: 1.0 (0.1M solution)	pH: N/A	pH: N/A

NOTE: The physical and chemical data provided are for the pure components. No physical or chemical data are available for this solution of neodymium and nitric acid. The actual behavior of the solution may differ from the individual components.

10. STABILITY AND REACTIVITY

Stability: X Stable Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Heat and incompatible materials.

Incompatible Materials:

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Neodymium Nitrate: Incompatible with combustible, organic, or readily oxidizable materials (may ignite or explode).

Neodymium: Incompatible with strong oxidizing agents, strong acids, halogens, phosphorus oxide, nitrogen, moisture, and air. Contact with phosphorus may cause explosion.

Fire/Explosion Information: See Section 5.

Hazardous Decomposition: Thermal decomposition of nitric acid or neodymium nitrate can produce nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), and nitrous oxide (N₂O). Nitric acid mist or vapor may also be produced. Thermal decomposition of neodymium may release neodymium oxides.

Hazardous Polymerization: ☐ Will Occur ☒ Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: ☒ Inhalation ☒ Skin ☒ Ingestion

Nitric Acid:

Human, oral: LD_{Lo} = 430 mg/kg

Rat, oral: LD₅₀ > 90 mg/kg

Rat, inhalation: LC₅₀ (4 hrs) = 130 mg/m³

Neodymium Nitrate:

Rat, oral: LD₅₀ = 2072 mg/kg

Rat, intraperitoneal: LD₅₀ = 270 mg/kg

Rat, intravenous: LD₅₀ = 4800 µg/kg

Neodymium: No acute toxicity data found for elemental Nd.

Target Organ(s): Skin, eyes, respiratory tract, GI tract, central nervous system, blood, kidneys.

Mutagen/Teratogen: Nitric acid has caused birth defects in animals under experimental conditions, and has also been investigated as a possible mutagen. The rare earth metals in general are not known to cause mutations or birth defects, but neodymium and its compounds have not been fully investigated. Neodymium oxide (Nd₂O₃) may induce chromosomal aberrations in mice and other organisms.

Health Effects: See Section 3.

12. ECOLOGICAL INFORMATION

Nitric Acid, Ecotoxicity Data:

Green shore crab (*Carcinus maenas*): LC₅₀ (48 hrs) = 180,000 µg/L

Starfish (*Asterias rubens*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L

Hooknose (*Agonus cataphractus*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L

Brook trout (*Salvelinus fontinalis*): NR-LETH = 1,562 µg/L

Cockle (*Cerastoderma edule*): LC₅₀ (48 hrs) = 330,000 to 1,000,000 µg/L

Neodymium Nitrate: No ecotoxicity data were found.

Neodymium: No ecotoxicity data were found.

Environmental Summary: The ecological effects of this mixture have not been fully evaluated. Do not release to the environment.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: One or more components of this mixture are classified as RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: Nitric Acid: Hazard Class 8, UN2031, Packing Group II

15. REGULATORY INFORMATION

U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Nitric Acid: RQ = 1000 lb.

Neodymium Nitrate: Not regulated

Neodymium: Not regulated

SARA Title III Section 302: Nitric acid is regulated

SARA Title III Section 304: Nitric acid is regulated

SARA Title III Section 313: Nitric acid and neodymium nitrate (N511, Nitrate Compounds) are regulated.

OSHA Process Safety (29 CFR 1910.119): Nitric acid at higher concentrations ($\geq 94.5\%$) is regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE: Yes

CHRONIC: Yes

FIRE: No

REACTIVE: Yes

SUDDEN RELEASE: No

STATE REGULATIONS

California Proposition 65: No components are regulated.

CANADIAN REGULATIONS

WHMIS Classification:

Nitric Acid: C (oxidizing material), D1A (very toxic material), E (corrosive material)

Neodymium Nitrate: C (oxidizing material)

Neodymium: D2B (toxic material)

WHMIS Ingredient Disclosure List: Nitric Acid is regulated.

CEPA Domestic Substances List (DSL): Nitric acid and neodymium are regulated.

EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)

Neodymium Nitrate: O (Oxidizer); not found in ESIS database.

Neodymium: XN (Harmful); not classified in Annex I of Directive 67/548/EEC; not on a priority list.

Risk Phrases (mixture):

R23 (toxic by inhalation)

R25 (toxic if swallowed)

R34 (causes burns)
R36/37/38 (irritating to eyes, respiratory system and skin)

Safety Phrases (mixture):

S20/21 (when using, do not eat, drink or smoke)
S28 (wash after contact with skin)
S45 (in case of accident or illness, see doctor; show label)
S60 (dispose of this material and its container as hazardous waste)

NATIONAL INVENTORY STATUS

U.S. Inventory (TSCA): Nitric acid and neodymium are listed.

TSCA 12(b), Export Notification: No components are listed.

16. OTHER INFORMATION

Sources:

Haley TJ, Pharmacology and toxicology of the rare earth elements. *Journal of Pharmaceutical Sciences* 1965;54(5):663-670.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, June 1990 edition. DHHS (NIOSH) Publication No. 90-117.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.